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(56) Documents Cited
GB 2180424 A **US 4377006 A**
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(57) Apparatus (2, Fig. 1) for providing a driver of a vehicle (4, Fig. 1) with at least a lap time of the vehicle (4) when the vehicle (4) is travelling a number of laps over a racing track (6, Fig. 1) which apparatus (2) comprises infrared transmitter means (8, Fig. 1) and infrared receiver means (10, Fig. 1), the transmitter means (8) and the receiver means (10) being for positioning one on the vehicle (4) and one at a side of the racing track (6), and the transmitter means (8) comprising an infrared transmitter 18, a pulse generator 20 for feeding pulses to the transmitter 18, shift register means 22 for providing a logic 0 or a logic 1 at an input for the pulse generator 20, at least one digitally controlled analogue switch 24 connected to at least one input of the shift register means 22, and counter means 26 for changing the state of the digitally controlled analogue switch 24 after each reading of the shift register means 22 in order to enable a next reading of the shift register means 22.

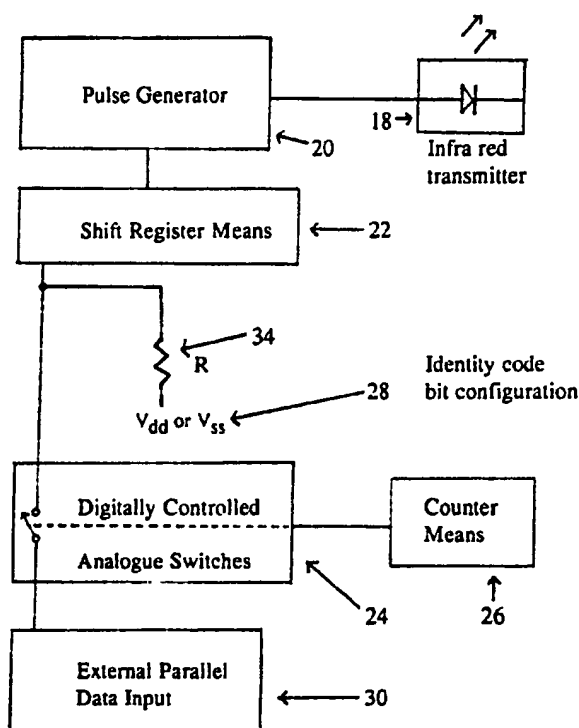


Fig 3

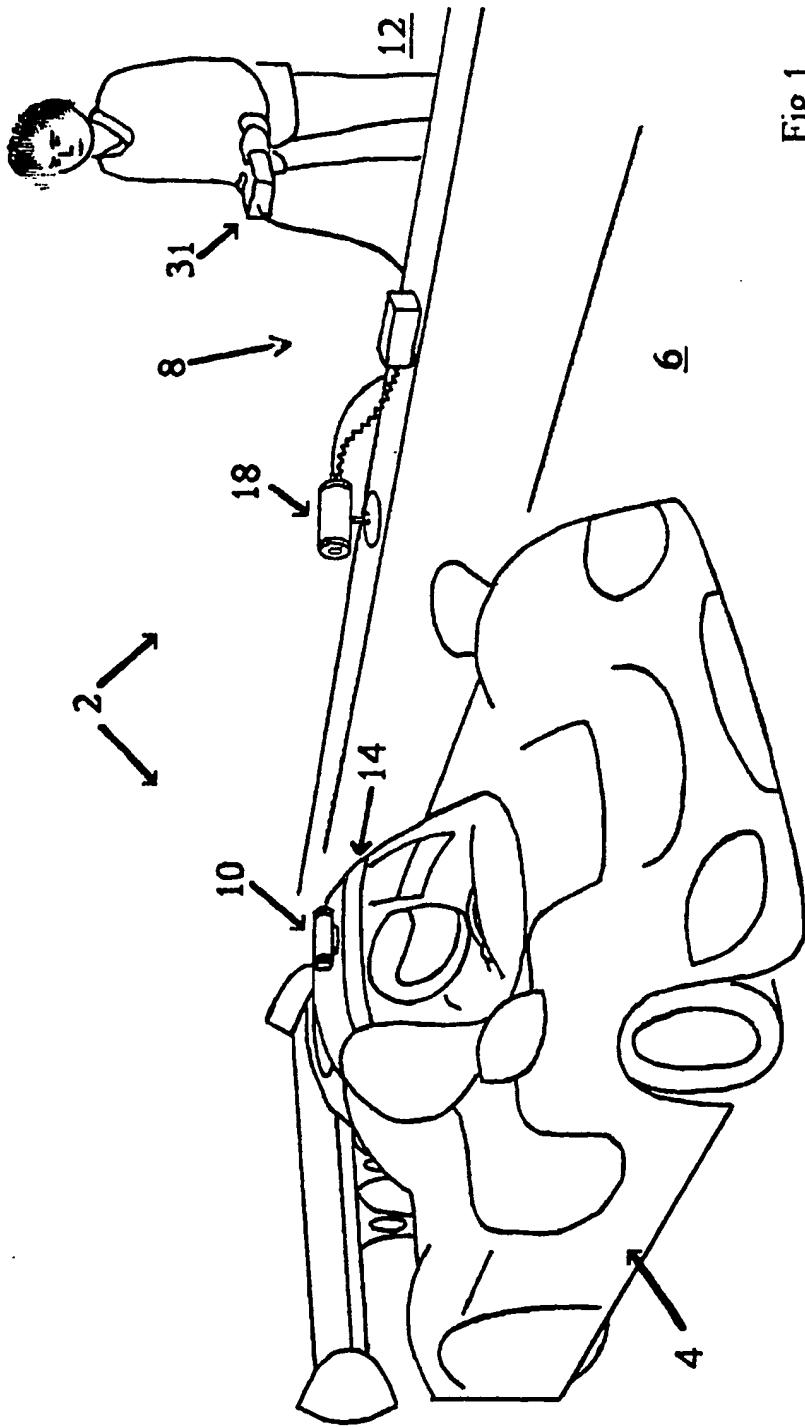


Fig 1

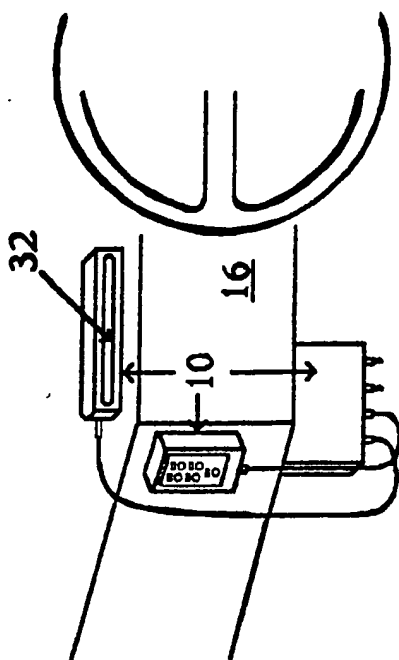


Fig 2

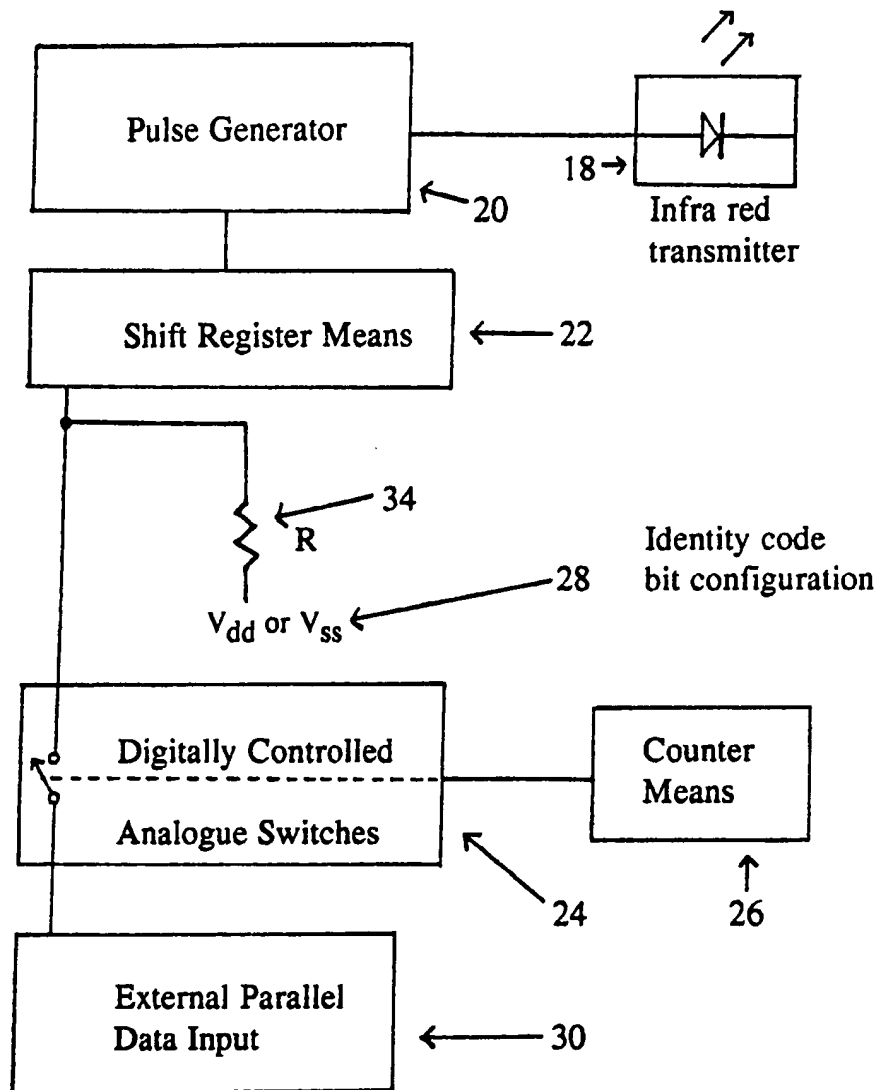


Fig 3

LAP TIMING APPARATUS

This invention relates to lap timing apparatus and, more especially, this invention relates to apparatus for providing a driver of a vehicle with at least a lap time of the vehicle when the vehicle is travelling a number of laps over a racing track.

Apparatus is known for providing a driver of a vehicle with a lap time of the vehicle when the vehicle is travelling a number of laps over a racing track. The vehicle will usually be a racing vehicle such for example as a racing car or a racing motorbike.

One such known type of lap timing apparatus comprises a radio transmitter means placed by the side of the racing track, and receiver means provided on the vehicle. The transmitter means emits a coded stream of radio wave pulses and this coded stream of radio wave pulses is intercepted by the receiver means each time the vehicle passes the transmitter means. The receiver means enables a lap time to be calculated and displayed to the driver of the vehicle.

Another known type of lap timing apparatus comprises transmitter means which is mounted on the vehicle and which is for providing coded radio waves. This known type of apparatus has receiver means which is either in the form of a trackside receiver or a master receiver.

The lap time is calculated remote from the vehicle and the calculated lap time is then transmitted to a visual display in the vehicle.

In addition to providing lap times, the above mentioned known apparatus is also able to provide a transfer of data to the vehicle so that, when the vehicle intercepts its own trackside transmitter or receiver, communication is able to take place between the trackside and the vehicle, or vice versa, or both.

The known apparatus operates well in theory but in practice suffers from severe limitations. More specifically, racing is an international sport which is carried on in many different countries. These different countries have different laws governing the use of radio waves and the known lap timing apparatus using radio waves has to be such as to be within the radio wave licensing requirements of all the different countries in which racing takes place. This in turn makes the design of the known lap timing apparatus limited and/or impractical.

It is known to overcome the problems associated with lap timing apparatus using radio waves by employing lap timing apparatus using infrared electromagnetic radiation. The known types of lap timing apparatus using infrared radiation use and rely on commercially available integrated circuits designed to generate and transmit

infrared pulses of data. Also, there is usually a designed matching receiver to convert the infrared pulses to logic signals. The commercially available integrated circuits generally operate at slow speeds in relation to what is required for accurate lap timing and data transfer. Also, the commercially available integrated circuits have a limited number of codes that can be transmitted, thereby greatly restricting the total number of uniquely assignable codes to each transmitter/receiver. Still further, the data rate, that is the baud rate, is fixed by the manufacturers of the commercially available integrated circuits and this, together with the above mentioned limitation on the number of code permutations, leaves little scope for originality of design in new lap timing apparatus.

It is an aim of the present invention to obviate or reduce the above mentioned problems.

Accordingly, in one non-limiting embodiment of the present invention there is provided apparatus for providing a driver of a vehicle with at least a lap time of the vehicle when the vehicle is travelling a number of laps over a racing track, which apparatus comprises infrared transmitter means and infrared receiver means, the transmitter means and the receiver means being for positioning one on the vehicle and one at a side of the racing track, and the transmitter means comprising an

infrared transmitter, a pulse generator for feeding pulses to the transmitter, shift register means for providing a logic 0 or a logic 1 at an input for the pulse generator, at least one digitally controlled analogue switch connected to at least one input of the shift register means, and counter means for changing the state of the digitally controlled analogue switch after each reading of the shift register means in order to enable a next reading of the shift register means.

Usually, the apparatus will be one in which the receiver means is for positioning on the vehicle, and in which the transmitter means is for positioning at the side of the racing track. The alternative arrangement may however be employed in which the receiver means is for positioning at the side of the racing track, and in which the transmitter means is for positioning on the vehicle.

The apparatus of the invention may be one which includes identity code input means for inputting at least one identity code to be transmitted, and external parallel data input means for inputting at least one data code to be transmitted.

The apparatus of the invention may include a hand-holdable transmitter for use at the side of the racing track and for transmitting to the vehicle a message which is in addition to the lap time. Examples of such

messages are PIT CALL, POSITION and a number, and TYRES...IN.

The vehicle can travel one or more laps of the racing track. When the apparatus includes the hand-holdable transmitter, the apparatus usually operates by alternate loading and reading of the identity code followed by the loading and reading of the data code. The apparatus may be modified to provide many identity code permutations and many data code permutations. As an alternative to transmitting alternate identity codes followed by data codes, it may be desirable to transmit an identity code twice, followed by a data code twice, and so on. It is also possible for other combinations of codes to be made to repeat in an alternate manner.

The spacing between the pulses generated by the pulse generator is an important factor in determining the overall accuracy of the generated lap time. A practical design of apparatus in accordance with the invention is for the shift register means to comprise one or two shift registers only, thereby limiting the number of bits per code in conjunction with very short spacings between pulses of infrared light. This creates a fast baud rate using codes comprising an economic number of bits.

The apparatus of the invention may enable lap timing and communication to be effected at an accuracy and resolution of 0.001 seconds or better.

An embodiment of the invention will now be described solely by way of example and with reference to the accompanying drawings in which:

Figure 1 illustrates the apparatus in use;

Figure 2 shows part of the apparatus used in Figure 1; and

Figure 3 is a block circuit diagram of transmitter means used in the apparatus shown in Figure 1.

Referring to the drawings, there is shown apparatus 2 for providing a driver of a vehicle 4 with at least a lap time of the vehicle 4 when the vehicle 4 is travelling a number of laps over a racing circuit 6. The apparatus 2 comprises infrared transmitter means 8 and infrared receiver means 10. As can be seen from Figure 1, the transmitter means 8 is positioned at a side 12 of the racing track 6, whilst the receiver means 10 is positioned partly on a roof 14 of the vehicle 4 and partly on a dashboard 16 inside the vehicle 4 (see Figure 2).

The transmitter means 8 comprises an infrared transmitter 18, a pulse generator 20 for feeding pulses to the transmitter 18, and shift register means 22 in the form of one, two or more shift registers. The shift register means 22 is for providing a logic 0 or a logic 1 at an input for the pulse generator 20.

The transmitter means 8 still further comprises at least one digitally controlled analogue switch 24 connected to at least one input of the shift register means 22 as shown. The apparatus 2 still further comprises counter means 26 which is connected to the digitally controlled analogue switch 24 and which is for changing the state of the digitally controlled analogue switch 24 after each reading of the shift register means 22 in order to enable a next reading of the shift register means.

The apparatus 2 still further comprises vehicle identity code input means 28, and external parallel data input means 30 for inputting at least one data code to be transmitted.

Figure 1 shows how a hand-holdable transmitter 31 is used at the side 12 of the racing track 6 and transmits to the vehicle 4 a message which is in addition to the lap time. This message may be PIT CALL, POSITION and a number, or TYRES...IN. Other messages may be provided. The total number of identity code and message permutations is determined by the number of shift registers employed in the shift register means 22 and by the number of inputs used to the shift registers.

During operation of the apparatus 2, the vehicle 4 can travel one or more laps of the racing track 6. The apparatus 2 operates by the alternate loading and

reading of an identity code. When the hand-holdable transmitter 31 is operated, the alternate loading and reading of the identity code is followed by the loading and reading of a data code. When the vehicle 4 intercepts a continuous beam of identity codes or alternating identity and data codes, the receiver means 10 detects the coded infrared pulses, thereby enabling the receiver means 10 to know when it is intercepting its own transmitter means 8. This avoids the vehicle 4 intercepting and receiving data intended for another racing vehicle that might be in a race over the racing track 6. If a steady stream of identity codes is detected in sequence, then the apparatus 2 operates such that a lap time is calculated and displayed to the driver of the vehicle 4 in a display panel 32 forming part of the receiver means 10. If the apparatus 2 detects the alternating identity and data codes, then a lap time and a message are displayed to the driver of the vehicle 4.

The pulse generator 20 operates such that it receives a logic 0 or a logic 1 at its input from the shift register means 22. When this happens, a timed spacing is determined between infrared output pulses. The shift register means 22 has one, two or more parallel in/serial out shift registers with one or more inputs connected via resistors such as the resistor 34 to either a positive rail Vdd or to ground Vss. The external

parallel data input means 30 enables the selection of a particular data code to be transmitted. The counter means 26 operates such that when all the shift registers in the shift register means 22 have been read once and converted into infrared pulses, then the digitally controlled analogue switches are caused all to switch from all ON to all OFF or vice versa, enabling a new read of the shift register inputs to take place. This action permits alternated loading and reading of the identity code followed by loading and reading of the data code.

It is to be appreciated that the embodiment of the invention described above with reference to the accompanying drawings has been given by way of example only and that modifications may be effected. Thus, for example, the apparatus 2 can be expanded to provide many identity code permutations and many data code permutations.

CLAIMS

1. Apparatus for providing a driver of a vehicle with at least a lap time of the vehicle when the vehicle is travelling a number of laps over a racing track, which apparatus comprises infrared transmitter means and infrared receiver means, the transmitter means and the receiver means being for positioning one on the vehicle and one at a side of the racing track, and the transmitter means comprising an infrared transmitter, a pulse generator for feeding pulses to the transmitter, shift register means for providing a logic 0 or a logic 1 at an input for the pulse generator, at least one digitally controlled analogue switch connected to at least one input of the shift register means, and counter means for changing the state of the digitally controlled analogue switch after each reading of the shift register means in order to enable a next reading of the shift register means.

2. Apparatus according to claim 1 in which the receiver means is for positioning on the vehicle, and in which the transmitter means is for positioning at the side of the racing track.

3. Apparatus according to claim 1 or claim 2 and including identity code input means for inputting at least one identity code to be transmitted, and external parallel data input means for inputting at least one data code to be transmitted.

4. Apparatus according to any one of the preceding claims and including a hand-holdable transmitter for use at the side of the racing track and for transmitting to the vehicle a message which is in addition to the lap time.

5. Apparatus according to claim 1 and substantially as herein described with reference to the accompanying drawings.

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Examiner's report to the Comptroller under Section 17
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Search Examiner
DR E PLUMMER

Date of completion of Search
24 FEBRUARY 1994

Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

Documents considered relevant following a search in respect of Claims :-

(ii) ONLINE DATABASE: WPI

Categories of documents

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|---|---|

Category	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2180424 A (SHORROCK SECURITY)	
A	US 4377006 (ZENITH)	
A	Derwent Accession Number 84-128579 and DE 3340757	
A	Derwent Accession Number 84-195328 and CA 1170723	

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